The Community Environmental Monitor

ACAP SAINT JOHN

# The 1993 Volunteer Monitor Pilot Project: Commitment and Training Produce Results!

## What are ACAP's goals?

The Autumn 1991 issue of *ACAP News* mentions the following items as being part of the Atlantic Coastal Action Programs mandate:

- A full-time community coordinator and office for each of the project sites.
- An assessment of the environmental quality of each of the areas, including the identification of all sources of environmental problems.
- The development of a long-term "Vision" for each of the areas, which will be supported by clear objectives necessary to attain the long-term goals.
- The identification and assessment of necessary remedial actions and conservation measures.
- The development of comprehensive environmental management plans.
- The promotion of environmental stewardship through education and awareness activities.
- The implementation of pilot projects that will demonstrate the importance and effectiveness of low-cost, innovative solutions to environmental issues in watersheds.



In Saint John, some of these goals have been attained, others are in progress. ACAP Saint John employs Frank Hogan as full-time Executive Director and has its headquarters in Suite 302 of Market Square. A "Vision" has been identified as have "use objectives" to facilitate the vision becoming a reality. A successful water monitoring pilot project was implemented by volunteers during the summer of 1993 – the Community Environmental Monitoring Program Committee is making plans to enhance and expand this program for future monitoring.

## We Are ACAP

Canada's Green Plan, released in December 1990, included an initiative to help improve and restore Atlantic Canada's coastal waters through a marine environmental program. This initiative resulted in the formation of the Atlantic Coastal Action Program (ACAP) which is intended to assist in the management of coastal resources in designated key areas of the Atlantic region. Letang, Miramichi, Madawaska, St. Croix/ Passamaquoddy, and Saint John represent the initial sites selected in New Brunswick.

## How We Function

ACAP's underlying philosophy is to interest a diverse cross section of the community to deal with issues affecting our coastal waters. To this end a "stakeholder" group has been set up with representatives from the general public, industry, business, utilities, heritage and education committees, environmental and conservation organizations, and three levels of government. Perhaps the backbone of the "Action" in ACAP are working Committees set up to deal with specific needs. The Technical Advisory Commitee and the Community Environmental Monitoring Committee are two examples of seven such groups presently on the go. Participants within these committees need not be ACAP members.

## Community Environmental Monitoring

Early in the ACAP Saint John program a need was identified for gathering specific information on the quality of water within the ACAP boundaries. From this need evolved the Water Quality Monitoring Committee which undertook to operate a citizen-based water quality monitoring program during the summer of 1993. During the course of the project it was recognized that the potential for citizen-based monitoring extended beyond water alone; thus the group changed its name to Community Environmental Monitoring Program (CEMP) to encompass additional monitoring possibilities (for example - seaweed, birds).


The geographic scope for ACAP Saint John is generally identified as the estuary of the Saint John River, coastal waters, and land contained within the area outlined as follows: from Cape Spencer extending west to include the southern boundary of the Saint John Port Corporation, to the western head of Little Musquash Cove, to the upriver point at Morrisdale (wharf), to Gondola Point.

## CEMP Pilot Project

A major undertaking of the CEMP Committee was the Water Quality Monitoring project during July and August of 1993. The primary focus of this pilot project was to set up a program in which community "volunteers" would conduct the actual sampling.

This pilot project would serve as a test run and was viewed by organizers as an opportunity to deal with logistical matters not easily foreseen during preliminary preparations but which would arise during the actual monitoring process. The project would nonetheless supply useful background data for comparison with future monitoring results in the same areas.

## Site Selection

A memorandum entitled "Survey of Priorities and Resources" was distributed to the ACAP Saint John membership in order to obtain feedback on particular locations considered to be prime candidates for the project. One of the paramount concerns in choosing a site for monitoring was safety; proximity to point and non-point discharges was another consideration.

After evaluating all input on possible monitoring locations, the CEMP Committee decided upon six sites for the 1993 pilot project: Little River, Marsh Creek, the Inner Harbour, South Bay, Duck Cove, and Saints Rest Marsh. Furthermore, it was decided that specific groups within the community would be approached to accept responsibility for monitoring at each designated site.

## Volunteer Water Monitoring Background

It is important to understand that although this monitoring project is new for Saint John, it is by no means the first of its kind. In fact, volunteer-based water monitoring programs have been ongoing in certain parts of the United States for some time. The level of volunteer organization south of the border was very apparent to four ACAP Saint John representatives who attended the 1993 Water Quality Monitoring Fair in Newcastle, Maine. Approximately 240 volunteers were able to learn from workshops featuring experts in citizen-based water monitoring.

Displays and resource tables operated by existing monitoring programs were also available. Participants selected from fifteen possible workshops covering a wide range of topics such as Study Design, Non-point Source Pollution Surveys, Sanitary Shoreline Surveys, Quality Assurance, Public Relations, Biological Monitoring, Storm Event Monitoring, and Chemical and Physical Monitoring.

There is a wealth of experience and information available to organizers and volunteers on how to successfully manage a water sampling program, thereby ensuring the collection of meaningful and accurate data. *The Volunteer Monitor* (subtitled The National Newsletter of Volunteer Water Quality Monitoring) is an excellent example of information (general and specific) available to enhance the success of programs such as the one in Saint John. Many other publications are produced by smaller groups which conduct monitoring programs with a specific mandate. We are not alone!

*Ray LaForest (second from left) demonstrates the field procedure to "fix" an oxygen sample for later analysis.*

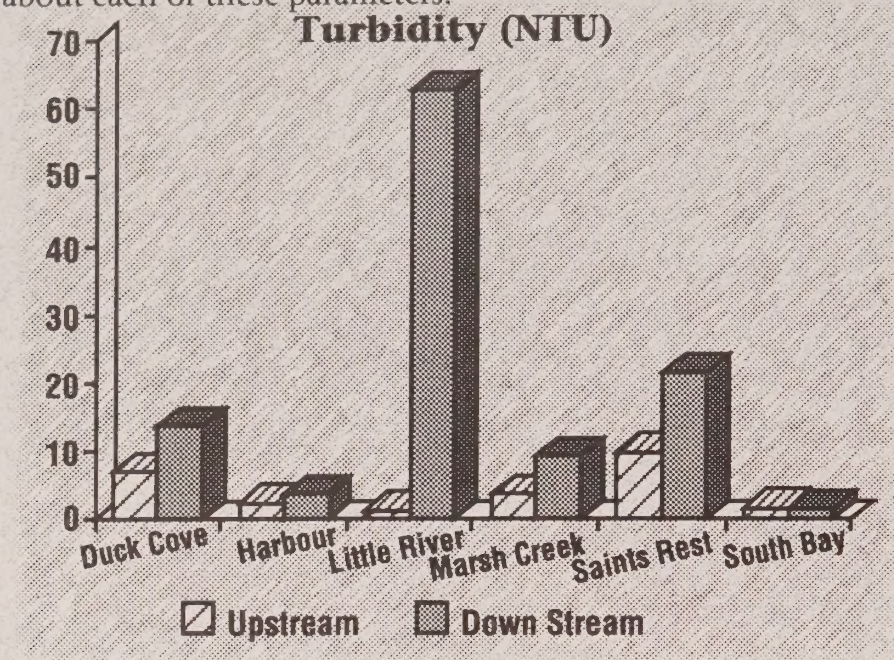
*Matt McKim (right) instructs volunteer Ross Mavis on proper sampling technique.*

## Preparing Volunteers

Proper training of volunteer monitors is crucial to the success of any citizen-based sampling program. To this end, the *ACAP Saint John Community Environmental Monitoring Handbook* was prepared specifically for participants in the Saint John water quality monitoring project. This manual outlines the purpose of the program and presents details on the water parameters and field procedures involved in the project. A full day training session was held to explain to volunteers the significance of these parameters and procedures, followed by hands-on sampling at one of the project sites.

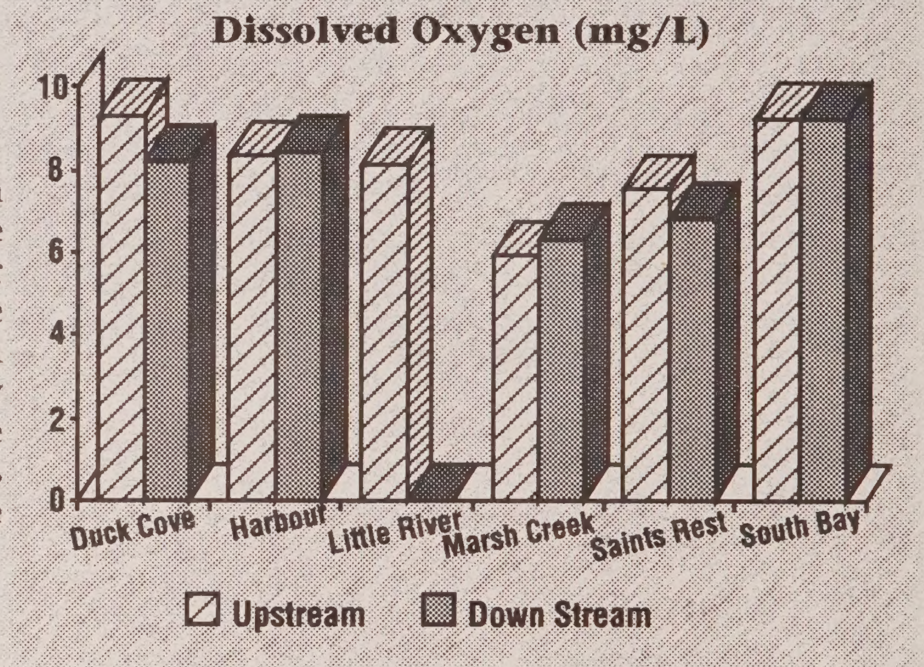
The volunteers were shown onsite how the actual analysis would be conducted in the Chemical Technology lab at the Saint John Campus of the New Brunswick Community College.

The 1993 Water Quality Monitoring Pilot Project yielded a Technical Report which summarized the observations of the community monitors and compiled all measurements. This report was formally presented by Matthew McKim to a special meeting of volunteers on October 7, 1993. The following graphs and summary illustrate results for dissolved oxygen, turbidity, salinity, pH and temperature at each of the six locations sampled. Page six provides specific details about each of these parameters.



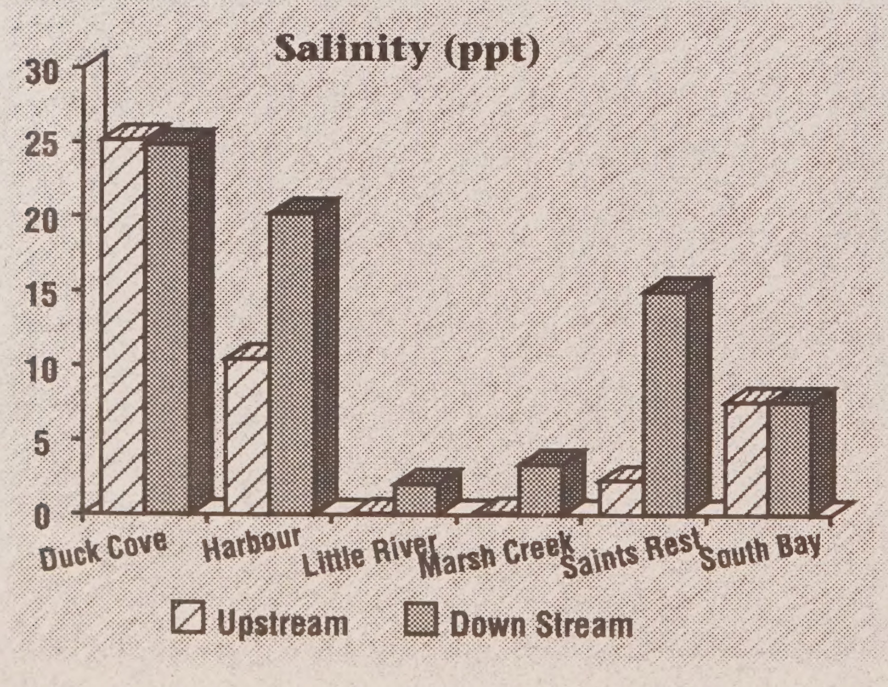

## *Turbidity*

The only location which unequivocally demonstrated an increase in turbidity due to human activity was Little River, where clear upstream water contrasted with essentially opaque water at the mouth of the river. The Marsh Creek downstream site was also consistently higher in cloudiness than was the upstream site. Other locations, especially Duck Cove and Saints Rest Marsh, showed wide swings in cloudiness that may have been due to sediment suspended by waves and current.



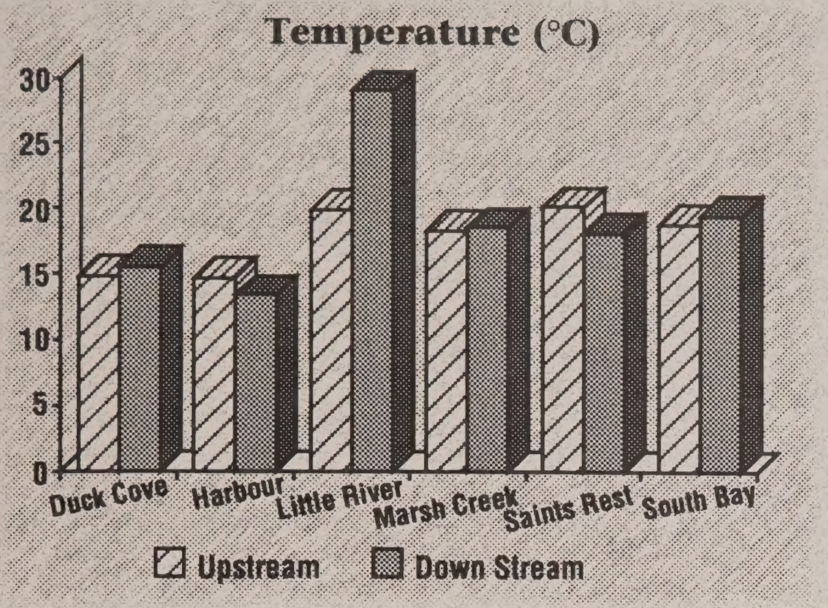

## *Dissolved Oxygen (DO)*

The most dramatic results for dissolved oxygen sampling occurred at Little River, where the upstream sampling station indicated near saturation (maximum DO) values and the downstream site reported zero dissolved oxygen in every sample. This absence of DO severely alters the natural species composition of the ecosystem. Marsh Creek had several DO readings below 5mg/L. Levels below this value can cause stress to fish and other marine animals.



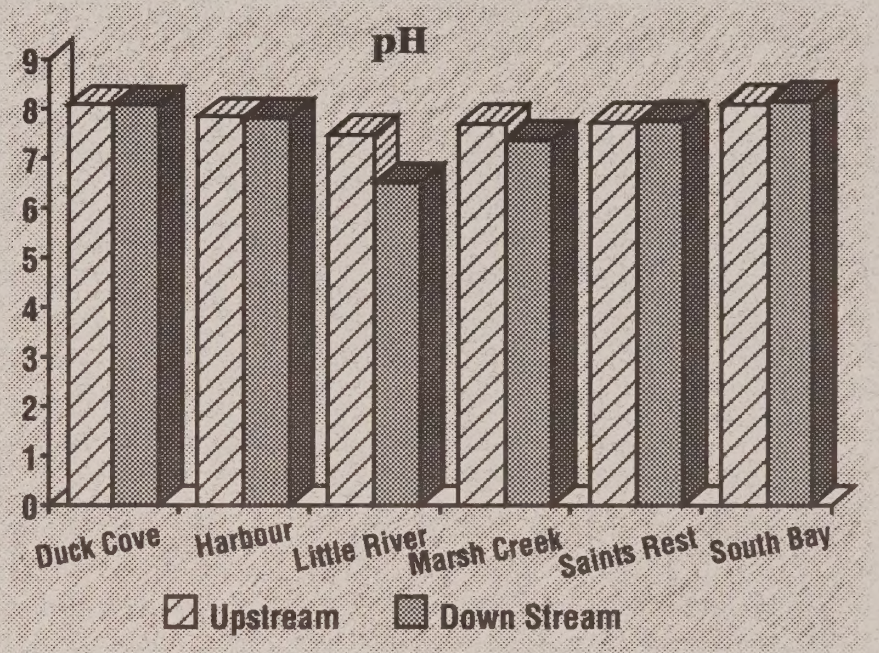

## *Salinity*

For the most part the source of the salt content for each location is natural tidal action from the Bay of Fundy. The exception would be Little River where industrial discharges apparently contributed to the increase in salt at the downstream site.




## *Temperature*

Water temperature variation between upstream and downstream sites did not differ significantly except at Little River, where the average downstream temperature of 29.0 °C severely restricts the possibility of aquatic life. This notable rise in temperature from the upstream value of 19.9 °C appears to be the result of industrial effluent.




## *pH*

With the exception of Little River, the pH tests to determine the acid or base component of water at each location did not show significant differences between the upstream and downstream sampling stations.

## *CONCLUSIONS*

The project's technical report concluded that:

1. Triplicate sampling demonstrated that volunteer monitors can obtain reproducible samples with acceptable variations.
2. The lower part of Little River is grossly degraded with respect to dissolved oxygen, temperature and turbidity.
3. The Dissolved Oxygen depletion and the increase in turbidity of Marsh Creek compromises the possible uses of this water body.
4. Locations within the Saint John estuary with high water flows and exchange (South Bay, Harbour, and Duck Cove) have acceptable water quality with respect to the parameters investigated.

## *RECOMMENDATIONS*

1. Community environmental monitoring should be expanded from a pilot project to a permanent program of environmental assessment and education.
2. The water quality parameters should be extended to include microbiological monitoring so as to reflect the influence of sanitary constraints on water uses.
3. Samples should be exchanged with professional monitors/ analysts to provide further quality control.

# Water Quality Parameters

**Water Temperature** plays a major role in the distributions and activities of marine organisms. Many physical, biological, and important chemical processes are temperature-dependent. For example, naturally occurring gases (e.g. oxygen) are less soluble in warm than in cool water. Increases in temperature will result in a corresponding increase in metabolic rates of organisms which use oxygen as they consume organic materials. When temperature tolerance limits for marine organisms are exceeded, some species become stressed and are thereby more vulnerable to toxic chemicals, diseases, and parasites. Others cannot continue to function and simply die. The discharge of industrial effluents and cooling water from thermal electric plants can significantly raise the temperature of water in the stream or river into which it flows. Temperature readings were taken using an alcohol thermometer (mercury contained in conventional thermometers is very toxic).

**Salinity** is the concentration of dissolved salts in water, usually expressed in parts of salts per thousand parts of water (ppt). Fresh water contains few salts (for example, the salinity of drinking water usually measures less than 0.5 ppt). The world's oceans, on the other hand, average 35 ppt with only small variation (33 to 37 ppt). Salinity is a principal factor in the distribution of marine organisms, especially when it decreases to well below levels found in sea water. In estuaries (areas where rivers flow into the ocean), salinity is subject to change by both tidal action and dilution by fresh water from the land. Small tributary streams and rivers may be subject to salinity changes through road salt run-off and industrial effluents. Water samples were measured for salinity with a conductivity meter.

**pH** is an indication of how acidic or basic (alkaline) a solution is. In any solution some atoms of water will dissociate to form hydrogen (H+) or hydroxyl (OH-) ions. pH measurements can range from 0 to 14, with a pH of 7 (e.g. pure water) being considered neutral. A pH less than 7.0 is an acidic solution (more hydrogen ions than hydroxyl), while a pH greater than 7.0 is considered basic (greater relative number of hydroxyl ions). pH is measured on a logarithmic scale, thus a pH of 9 represents a tenfold increase over a pH of 8. Ocean water is a highly buffered solution meaning it is able to resist changes in pH. Fresh water, however, does not have the same buffering capacity as ocean water, thereby making it more susceptible to changes in pH. Removal of carbon dioxide ($CO_2$) by plants during photosynthesis (increasing pH), acid rain, human wastes, and industrial effluents can affect the pH of water. The optimum pH range for fresh water is between 6.5 and 8.2, although many fish can tolerate pH between 5 and 9. Small changes in pH can have profound effects upon aquatic life. For example, when water with a low pH comes in contact with certain chemicals and metals, the acid may cause these substances to become more soluble (and more toxic) than normal. Thus fish that may otherwise be able to withstand pH as low as 4.8 may die at a pH of 5.5 if low concentrations of lead, mercury, aluminum or iron are present. Likewise, an elevated pH can greatly increase the toxicity of ammonia to fish. The pH of water samples in this project were measured using a pH meter.

**Turbidity**, also called transparency, is a measure of fine solid suspended particles which scatter light passing through the water. Common sources of turbidity include eroded soil, algae, microscopic organisms, resuspended bottom sediment, and industrial and municipal wastes. Silt in early spring run-off typically makes water more turbid; likewise in late spring and early fall there can be a decrease in transparency due to plankton and algal blooms. Transparency affects fish and other aquatic life by: restricting photosynthetic processes and increasing respiration, oxygen consumption and the production of carbon dioxide; clogging of fish gills and the feeding mechanisms of bottom dwelling animals; reducing the ability of fish to see food; smothering of bottom-dwelling animals; and allowing for pesticides and other pollutants to be transported by the suspended solids. Turbidity was measured in the lab with an instrument called a turbidimeter.

**Dissolved Oxygen** (DO) is critical for respiration of most aquatic life just as oxygen is essential for humans and land animals. It is also a particularly sensitive constituent of water because temperature, biological processes, chemicals, salinity, and atmospheric pressure all have a pronounced effect on DO levels. In fresh water, for example, an increase in temperature from 0 to 30 °C will result in a decrease in oxygen solubility (measured in ppm - parts per million) by nearly one-half. In salt water the results are similar. One of the primary sources of oxygen in water is absorption from the atmosphere. Another significant source is from aquatic plants which, during photosynthesis, remove carbon dioxide from the water and replace it with oxygen. The tolerance of marine life for low dissolved oxygen conditions is extremely varied; however, levels below 5 ppm typically places undue stress upon many species in the marine community. In addition to being used by marine animals for basic metabolic processes, oxygen is also consumed by bacteria decomposing dead plants and animals. Untreated wastewater from municipalities, food processing plants, and pulp and paper mills are common sources of oxygen consuming substances. The dissolved oxygen (DO) content of water samples was determined by the "Winkler" procedure, whereby samples were "fixed" in the field by adding chemical reagents to preserve the oxygen content until the analysis could be completed back in the lab.

## The Sampling Process

Sampling occurred at low tide on the same weekday during daylight hours throughout the summer. This generally meant that sample times alternated weekly between early evening (7 to 8 p.m.) and late morning (11 to 12 noon). A Field Sheet was provided in which the location, date, weather conditions, site observations and collectors names were recorded. Ongoing changes in site observations can be very important; Les Walting, a keynote speaker at the Maine conference, encouraged volunteers to be good amateur natural historians. Samples were taken at precise points at each station - the exact location of these sites were forwarded to Environment Canada for registration as a Water Survey Canada Station. Two sets of samples were obtained from each location, where appropriate, one upstream of sources of pollution and one downstream. This permitted useful "before and after" comparisons. Measures to prevent sample contamination are outlined in the ACAP Saint John Monitoring Handbook.

## Quality Control and Assurance

Various measures were taken to ensure that the results of sampling and analysis were valid. Standard water samples (with known values for the different parameters), and distilled water "blanks" (with zero concentrations) were used to check the accuracy of chemical analysis. Volunteer sampling techniques were monitored by site visits by ACAP representatives. In addition, sets of three samples (triplicates) were obtained by the monitors at each site during the pilot program. Results from these triplicate samples demonstrated that monitors obtained very reproducible and reliable water quality data. This was echoed by comments from the peer review process.

## CWS – ACAP Project

A project has been initiated by the Canadian Wildlife Service (CWS) Atlantic Region to determine the effects of exposure of wildlife to toxic chemical pollution at five priority ACAP sites, including the Saint John location. The project will monitor the reproductive success of Tree Swallows and also the number and distribution of significant wildlife species at each ACAP site. Phamphlets with additional details on the project are available at the ACAP Saint John office.

## What Happened to the Samples?

During the 1993 Pilot Project ACAP Saint John employed Ray LaForest, a Chemical Technology Co-Op student at NBCC, to assist in most facets of the monitoring program and specifically to conduct all tests on the water samples. Results were returned to the ACAP office and passed along to the volunteers so that they could see the results of their efforts.

### Canada-N.B. Water Agreement

The Canada-New Brunswick Water/Economy Agreement was signed by the federal and provincial ministers of environments in 1991 to provide a mechanism for the staff of Environment Canada and the New Brunswick Department of the Environment to jointly focus on the water resource issues as they pertain to economic development. Expenditures under the Agreement will total $2.25 million over five years with both governments contributing $1.125 million.

The agreement addresses water/ economy issues through four program areas:

- the Water Resources Program
- the Estuary Program
- the Economic Considerations Program
- the Public Education and Info. Program

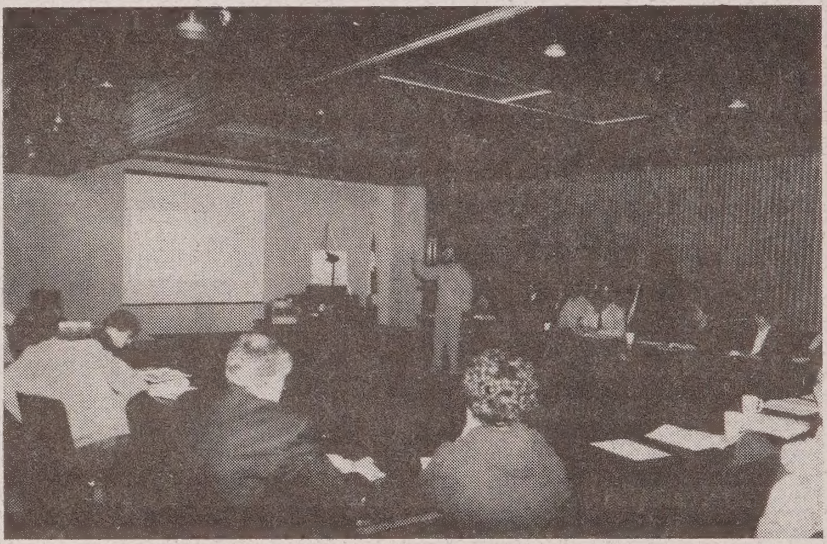
The recently released Saint John Harbour Study was partially funded through this agreement as was the Community-Based Water Quality Monitoring project with ACAP Saint John Inc. A commitment of $25,000, was made under the Agreement to support community based approaches to water quality monitoring. Four ACAP sites in New Brunswick each agreed to operate or initiate a water quality monitoring project. Each site received $5,000 towards this effort. To provide a legacy the groups also agreed to contribute in-kind support to develop a guideline document for community-based approaches. A manual is being developed that consolidates information from numerous sources including the USEPA, Environment Canada, and existing community projects.

## Wrap-up Meeting

On October 7, 1993 a special Pilot Project Wrap-up Meeting was held to update volunteers on the results of their efforts. Michael Richard, President of ACAP Saint John, thanked the volunteers for their commitment and spoke of the importance of being able to complete a citizen-based project of this nature.

Matthew McKim, Chairman of the Community Environmental Monitoring Program, made a formal presentation of the Pilot Project Report. Overhead graphs were used to illustrate the results of dissolved oxygen, turbidity, salinity, and pH of both upstream and downstream testing sites at each sampling location. Mr. McKim noted that throughout the summer not one sampling session was missed by any of the groups involved. Now that's commitment!

Kate Bredin of the Canadian Wildlife Service addressed the group regarding a CWS project currently underway at designated ACAP sites, including Saint John. Hugh O'Neill of Environment Canada spoke favourably of the project's results which confirm that, with proper training, committed volunteers can collect accurate and useful data.



*Matt McKim presenting Pilot Project Report to volunteers at Wrap-up Meeting.*

An important component of the meeting was feedback received from the volunteers on how they felt about the implementation of the project and suggestions for making it more effective. The meeting finished with the volunteers being presented with certificates, carrying bags, and special caps noting their contribution to ACAP Saint John.

## Where We Go From Here...

With a successful pilot project complete, it is now time to evaluate the future of the program and changes that can strengthen it for 1994. Efforts will be made to implement the recommendations of the Project's Technical Report which include microbiological monitoring and the exchange of samples with professionals to provide a further quality control. Ecological sampling (e.g. seaweed) and storm-event monitoring are being considered as well.

Other suggestions are being assessed. Customized sampling may be developed to deal with the individual needs of different sites. Adjusting sampling times away from the low tide guideline of the pilot project is another option. Off-season monitoring during the upcoming winter period will be evaluated. And we certainly hope that 1994 will see an increase in the number of monitoring locations, thereby increasing the need for new volunteers.

ACAP Saint John is committed to continue laying the groundwork for a permanent citizen-based monitoring program in our community. However, such a program requires individuals who recognize its value and who are willing to make a personal commitment of time and effort, especially during the summer months.


## Acknowledgements

*This pilot project was truly a collaborative effort. The Community Environmental Monitoring Committee (Chairman Matthew McKim and members Charles Graves, Lenta Hoben, Ray LaForest, Scott Campbell, Julie Dingwell, and Sue Buckley) met weekly for over half the year. Volunteers from five community groups (Ketepec Concerned Citizens, Saint John Naturalists' Club, Duck Cove Recreational & Heritage Association, Saint John Port Corporation, and South Central Citizens Coalition) collected every scheduled sample during the summer program. Finally, Steve Gamblin of Gem Photo produced the layout and graphics for this newsletter while Charles Graves wrote and edited the text.*


## Are You Interested?

If you think this project may be of interest to you personally, please contact the ACAP Saint John office at Market Square - drop by during regular office hours or call us at 652-2227. We'll be pleased to answer any questions you may have. Perhaps you'd like to be a volunteer monitor, perhaps you'd like to sit on the CEMP Committee, either way we'd sure like to hear from you. Without citizen involvement, there can be little "Action" in ACAP.